5. BOILER, STEAM GENERATOR, AND PROCESS HEATER TUNING PROCEDURE

REF:Reg. 9-7-604, Proposed Reg. 9-10-605

5.1 INTRODUCTION

Regulation 9-7-304.2 and Regulation 9-10-304.2 require that boilers, steam generators, and process heaters be tuned at least once every twelve months by a technician in accordance with the procedure specified in Section 9-7-604 and 9-10-605, respectively. The following tuning procedure has been developed to insure uniformity in the conduct of the tune-ups. This tuning procedure is based on a tune-up procedure developed by KVB, Inc. for the EPA.

Nothing in this Tuning Procedure shall be construed to require any act or omission that would result in unsafe conditions or would be in violation of any regulation or requirement established by Factory Mutual, Industrial Risk Insurers, National Fire Prevention Association, the California Department of Industrial Relations (Occupational Safety and Health Division), the Federal Occupational Safety and Health Administration, or other relevant regulations and requirements.

5.2 THE TUNING PROCEDURE

5.2.1 Operate the unit at the firing rate most typical of normal operation. If the unit experiences significant load variations during normal operation, operate it at its average firing rate.

5.2.2 At this firing rate, record stack-gas temperature, oxygen concentration, and CO concentration (for gaseous fuels) or smoke-spot number (for liquid fuels), and observe flame conditions after unit operation stabilizes at the firing rate selected. The smoke-spot number can be determined with ASTM test method D-2156-80 or with the Bacharach method. The Bacharach method is included in a tune-up kit that can be purchased from the Bacharach Company. Typical minimum oxygen levels for boilers at high firing rates are 0.5-3% for natural gas and 2-4% for liquid fuels. At low firing rates, typical minimum oxygen levels are 3-8% for natural gas and 5-8% for liquid fuels. If the excess oxygen in the stack gas is at the lower end of the range of typical minimum values, and if CO emissions are low and there is no smoke, the unit is probably operating at near optimum efficiency at this particular firing rate. However, complete the remaining portion of this procedure to determine whether still lower oxygen levels are practical.

5.2.3 Increase combustion air flow to the furnace until stack-gas oxygen levels increase by one to two percent over the level measured in Step 5.2.2. As in Step 5.2.2, record the stack-gas temperature, CO concentration (for gaseous fuels) or smoke-spot number (for liquid fuels), and observe flame conditions for these higher oxygen levels after boiler operation stabilizes.

5.2.4 Decrease combustion air flow until the stack-gas oxygen concentration is at the level measured in Step 5.2.2. From this level, gradually reduce the combustion airflow in small increments. After

each increment, record the stack-gas temperature, oxygen concentration, CO concentration (for gaseous fuels) and smoke-spot number (for liquid fuels). Also, observe the flame and record any changes in its condition.

5.2.5 Continue to reduce combustion airflow stepwise until one of these limits is reached:

5.2.5.1 Unacceptable flame conditions - such as flame impingement on furnace walls or burner parts, excessive flame carryover, or flame instability

5.2.5.2 Stack-gas CO concentrations greater than 400 ppm

5.2.5.3 Smoking at the stack

5.2.5.4 Equipment - related limitations - such as low windbox/furnace pressure differential, built in airflow limits, etc.

5.2.6 Develop an O_2/CO curve (for gaseous fuels) or O_2/smoke curve (for liquid fuels) similar to those shown in Figures I-2 and I-3 using the excess oxygen and CO or smoke-spot number data obtained at each combustion airflow setting.

5.2.7 From the curves prepared in Step 6, find the stack-gas oxygen levels where the CO emissions or smoke-spot number equal the following values:

Fuel	Measurement	Value
Gaseous	CO Emissions	400 ppm
#1 and #2 oils	smoke-spot number	number 1
#4 Oil	smoke-spot number	number 2
#5 Oil	smoke-spot number	number 3
Other oils	smoke-spot number	number 4

The above conditions are referred to as the CO or smoke thresholds, or as the minimum excess oxygen levels. Compare this minimum value of excess oxygen to the expected value provided by the combustion unit manufacturer. If the minimum level found is substantially higher than the value provided by the combustion unit manufacturer, burner adjustments can probably be made to improve fuel and air mix, thereby allowing operations with less air.

5.2.8 Add 0.5 to 2.0 percent to the minimum excess oxygen level found in Step 5.2.7, unless the plant is authorized by the District in a permit condition to add a higher percentage to the minimum excess oxygen level of this source, and reset burner controls to operate automatically at this higher stack-gas oxygen level. This margin above the minimum oxygen level accounts for fuel variations, variations in atmospheric conditions, load changes, and nonrepeatability or play in automatic controls.

5.2.9 If the load of the combustion unit varies significantly during normal operation, repeat Steps 5.2.1 to 5.2.8 for firing rates that represent

the upper and lower limits of the range of the load. Because control adjustments at one firing rate may affect conditions at other firing rates, it may not be possible to establish the optimum excess oxygen level at all firing rates. If this is the case, choose the burner control settings that give best performance over the range of firing rates. If one firing rate predominates, setting should optimize conditions at that rate.

5.2.10 Verify that the new settings can accommodate the sudden load changes that may occur in daily operation without adverse effects. Do this by increasing and decreasing load rapidly while observing the flame and stack. If any of the conditions in Step 5.2.5 result, reset the combustion controls to provide a slightly higher level of excess oxygen at the affected firing rates. Next, verify these new settings in a similar fashion. Then make sure that the final control settings are recorded at steady-state operating conditions for future reference.

Figure I-2

Oxygen/CO Characteristic Curve

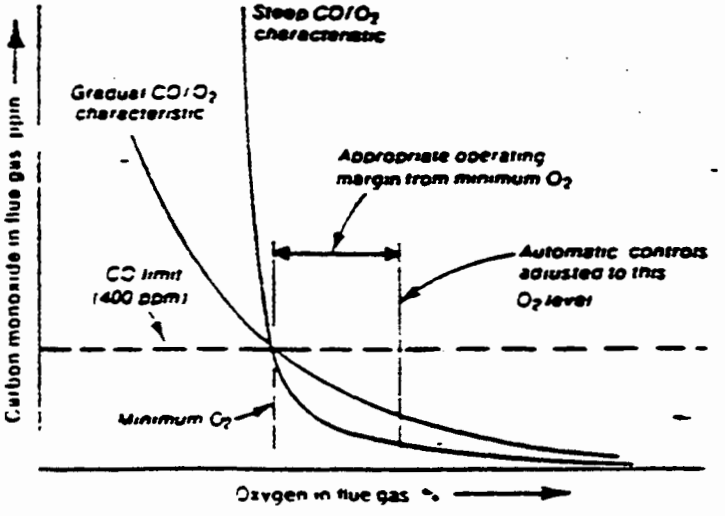
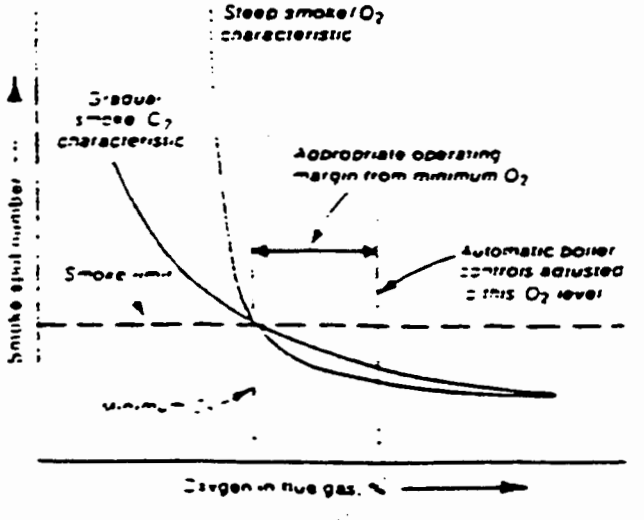


Figure I-3

Oxygen/Smoke Characteristic Curve



Source: KVB Inc.